

SPECIFICATION

TITLE OF THE INVENTION

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INFORMATION PROCESSING METHOD AND APPARATUS

FIELD OF THE INVENTION

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1a1 ~~The present invention relates to management of~~
10 ~~metadata to be attached to binary data, and more~~
~~particularly, to information processing method and~~
~~apparatus which enable high-speed access to metadata.~~

BACKGROUND OF THE INVENTION

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15 ~~Metadata is "data on data" used as explanation of~~
binary data such as image data and sound data. A search
for image data, sound data and the like can be made by
metadata set for respective binary data. Now the
usefulness of the metadata is widely known. Various
a forms of metadata are prepared for binary data, and
20 attempts to utilize them in searching by using data base
are made.

As binary data search methods, a method of
generating data base related to binary data as search
subjects and a method of performing a search by reading
25 metadata at whatever time are known. In the former case,
a search can be made at a high speed when an enormous
number of search subject data are prepared. However, the

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~~method cannot easily handle changes in situation due to~~
addition and/or deletion of binary data. Accordingly,
further proposed is a method having flexibility to changes
in situation due to addition and/or deletion of binary
5 data by describing binary data and metadata in the same
file and using the latter search method.

However, in the method of describing binary data
and metadata in the same file, when an enormous amount
of search subject data are provided, the speed of search
10 processing is extremely lowered since a search must be
made by reading files each including binary data and
metadata and extracting the metadata. Especially, when a
search is made for binary data stored in a storage
medium with a low access speed such as a magneto-optic
15 disk (MO), the speed of search processing is seriously
reduced.

~~SUMMARY OF THE INVENTION~~

20 ~~The present invention has been made in~~
~~consideration of the above problems, and has its object~~
~~to enable high-speed access to metadata of binary data~~
~~as a search subject.~~

Further, in case of metadata of independent-format
25 binary data, significant data cannot be extracted unless
the data is read in accordance with the format.
Accordingly, another object of the present invention is

to solve the problem and enable flexible access to internal data by using metadata described in highly versatile data description language.

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5 According to the present invention, the foregoing object is attained by providing an information processing method for storing binary data and metadata related to binary data into a storage medium, comprising an allocation step of allocating a first storage area for metadata in advance on the storage medium, a first
10 storage step of allocating a metadata storage area for storing metadata from the first storage area allocated at the allocation step, and storing metadata into the metadata storage area, a second storage step of storing
a binary data related to metadata into a second storage
15 area other than the first storage area on the storage medium, and a third storage step of storing link information that links metadata stored in the first storage area with binary data stored in the second storage area, in correspondence with metadata, into the
20 first storage area, wherein at third storage step, the link information is stored into an area adjacent to an area where metadata is stored.

Further, the foregoing object is attained by providing an information processing apparatus for
25 storing binary data and metadata related to the binary data into a storage medium, comprising allocation means for allocating a first storage area for metadata in

advance on the storage medium, first storage means for allocating a metadata storage area for storing metadata from the first storage area allocated by the allocation means, and storing metadata into the metadata storage area, second storage means storing binary data related to metadata into a second storage area other than the first storage area on the storage medium, and third storage means for storing link information that links metadata stored in the first storage area with binary data stored in the second storage area, in correspondence with metadata, into the first storage area, wherein the third storage means stores the link information into an area adjacent to an area where metadata is stored.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same name or similar parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of

according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 Preferred embodiments of the present invention will now be described in detail in accordance with the accompanying drawings.

<First Embodiment>

10 ~~As a first embodiment, information processing apparatus and method for high-speed access to metadata in a case where binary data and metadata are stored in the same file will be described.~~

Fig. 1 is a block diagram showing an example of system configuration according to the first embodiment.

15 In Fig. 1, a data reading unit 101 which reads data includes devices such as a scanner. A data input unit 102 which inputs an instruction from a user or data includes pointing devices such as a keyboard and a mouse. A storage unit 103, which is a device for storing a control program and the like, is generally a hard disk or the like. A display unit 104, which displays a GUI image and the like, is generally a CRT, or a liquid crystal display.

25 ~~A CPU 105 relates to all the processings in the above elements. A ROM 106 and a RAM 107 provide a program, data, a work area and the like necessary for processing to the CPU 105. Further, a control programs~~

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necessary for all the processings is stored in the
storage unit 103 or the ROM 106. In a case where the
control program to be executed is stored in the storage
unit 103, the program is temporarily read (loaded) onto
5 the RAM 107 and then executed by the CPU 105. A
recording unit 108, which is a device for storing binary
data and metadata, is an MO, DVD-RAM or the like.

Regarding the system configuration, various
constituent elements other than the above elements may
10 be provided and various modifications may be made to the
system, however, such matter is not the principal object
of the present invention, therefore the explanation
thereof will be omitted.

Hereinbelow, first, the structure of file in which
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15 binary data and metadata are stored will be described,
then a metadata storage area in which the metadata is
stored will be described, then processing to acquire the
metadata storage area will be described, and finally,
processing to save the file where the binary data and
20 the metadata are stored will be described.

(File Structure)

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Fig. 2 is a schematic diagram showing the
structure of binary data with metadata and form of data
25 storage into a storage medium. In the present embodiment,
binary data is a still image data in DCF (Design Rule
for Camera File System) (a unified digital camera general

storage area 503 is allocated for storing metadata by metadata area allocation processing to be described below, and the area is discriminated from a general area 504. Preferably the metadata storage area 503 is a continuous area. In a case where the storage area 503 is a continuous area, when metadata is referred to in search processing or the like, the processing can be made at a high speed. Further, as shown in Fig. 5, it is preferable that the metadata storage area 503 is allocated in the central portion of the disk 502 which can be accessed at a high speed. In this case, the speed of access to metadata is further improved.

(Metadata Allocation Processing)

15 Next, the metadata area allocation processing will
be described. In UDF, a disk area of particular
directory can be allocated in advance only for use of
file under the directory. However, in the present
embodiment, the metadata storage area is allocated by
20 generating an "area file" having a file size of metadata
storage area. The name of directory for which the
metadata area is allocated is designated when the area
is allocated by using the function of UDF. Accordingly,
the metadata area is assigned to the directory at the
25 same time when it is allocated. The allocation of
metadata storage area is performed by the user's
instruction after disk initialization. There is no

problem if the area allocation is automatically performed after the initialization by using a specialized driver or the like. In this manner, the allocation of metadata storage area by generating an area file is effective in a file system which lacks means for allocating a disk area in advance. Note that in this case, the allocation of metadata storage area may be made within a directory for storing binary data, or in other directories than the above directory.

Fig. 6 is a schematic diagram showing the storage area of a disk when a metadata storage area is allocated by generating an area file. As shown in Fig. 6, the metadata area 503 is allocated by generating an area file having the size of metadata storage area on the disk. When metadata is stored by file storage processing to be described later, the size of the area file is reduced in correspondence with the amount of the metadata. That is, the sum of the size of stored metadata and the size of the area file is always equal to the size of metadata storage area 503 (See Fig. 10).

Note that it is desirable that the area file is prevented from being erroneously deleted by setting a file attribute to invisible or setting write protection.

(Processing to Save File Including Binary Data and Metadata)

Next, a procedure for saving a file, having the

structure as shown in Fig. 2, on a storage medium where the metadata storage area is allocated as above will be described. Fig. 7 is a flowchart showing file storage processing according to the first embodiment.

5 First, at step S600, it is determined whether or not a save subject file is a file including metadata and binary data. In the present embodiment, it is determined whether metadata is included in a file by extracting the last 8 bytes of the file and examining whether or not
10 the 8 bytes correspond with "</PHOTO>". If the save subject file does not include metadata, the process proceeds to step S605, at which the file is saved in a general area, and the process ends. On the other hand, if the save subject file includes metadata and binary
15 data, the process proceeds to step S601. At step S601, a part enclosed with tags "<PHOTO>" and "</PHOTO>" is separated as metadata, thereby the binary data is extracted from the save subject file and written into the general area 504.

20 Next, at step S602, an area having a size necessary for storing the metadata (the above separated metadata) of the save subject file is allocated from the metadata storage area. In the present embodiment, a storage area necessary for each metadata is sequentially
25 allocated from the head of the metadata storage area. At this time, the size of the area file is reduced in correspondence with a size used for storage of metadata.

Then, at step S603, the metadata of the save subject file is written into the area allocated at step S602. Note that the details of the metadata storage processing at steps S602 and S603 will be described later with
5 reference to the flowchart of Fig. 8. At step S604, a pointer to refer to the binary data from the metadata is set, and the process ends. Note that the processing at step S604 will be described later with reference to the flowchart of Fig. 9.

10 Fig. 8 is a flowchart showing processing to allocate an area for storing metadata from the metadata storage area and store the metadata in the area.

First, at step S701, a storage start position L_{start} and a storage end position L_{end} of area file on the
15 storage medium are obtained. In the present embodiment, the positions L_{start} and L_{end} are represented by sector number. Next, to use a part of the area file (a part from the header) for storing the metadata, the area file is deleted at step S702. Then at step S703, the metadata
20 is stored from the storage start position L_{start} on the storage medium, and the process proceeds to step S704. At step S704, a next sector number to the storage end position is obtained as L'_{start} . At step S705, an area file is newly generated with the position L'_{start} as the
25 storage start position and the storage end position L_{end} , and the process ends.

By the above processing, the metadata is stored

from the head of the area (corresponding to the metadata storage area 502 in the initial state) allocated by the area file, and the remaining area is newly allocated by the area file.

5 Next, processing to establish linkage between the binary data stored in the general area 504 and the metadata (step S604) will be described. Fig. 9 is a flowchart showing the processing to establish linkage between binary data and metadata. Note that both data
10 can be linked with each other by storing information specifying the binary data in the metadata, however, in the present embodiment, information to link the metadata with the binary data (link information) is stored in 1-sector area (fixed length area) following the metadata
15 within the metadata storage area. In the present embodiment, the link information is a pointer which represents binary data to be linked by using a path and a file name. Note that the link information is not limited to that in the present embodiment but may be a
20 head number of sector holding binary data to be linked.

 In a case where the metadata includes description of link information specifying its related binary data, such processing is unnecessary. However, if the link information is stored independently of the metadata as
25 described above, linkage can be made in use of metadata which lacks description of link information, and the flexibility of the system can be improved.

At steps S801 and S802, as in the case of processing at steps S701 and S702, the storage start position L_{start} and the storage end position L_{end} of area file are obtained and then the area file is deleted.

5 Then at step S803, a pointer, i.e., a path and a file name of related binary data are stored in a sector designated by the position L_{start} . Then at step S804, the sector next to the position L_{start} is set as L'_{start} , and at step S805, as in the case of step S705, an area file
10 is generated by the positions L'_{start} and L_{end} , and the process ends.

In this manner, as link information to refer to binary data from metadata is added to the metadata, it is possible to read only the metadata storage area to
15 perform a search and extract necessary binary data.

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~~By the above described processing, when one file including binary data and metadata is stored into a storage medium, the binary data can be stored into the
a general area 504 and the metadata, into the metadata
20 storage area 503, respectively.~~

Fig. 10 is a schematic view explaining the status of file stored in the storage medium according to the first embodiment. Fig. 10 shows stored two files (file 1 and file 2) having binary data and metadata. As shown in
25 Fig. 10, binary data 1001 of the file 1 and binary data 1002 of the file 2 are stored in the general area. Metadata 1003 of the file 1, a pointer (link

information) 1004 from the metadata to the binary data
in the file 1, metadata 1005 of the file 2, a pointer
(link information) 1006 from the metadata to the binary
data in the file 2, are stored in the metadata storage
5 area. The remaining area is held as an area file 1007.

As described above, as metadata is stored in a
continuous area on a recording medium, only the metadata
can be read at a high speed. Further, as a pointer (link
information) to binary data related to the metadata is
10 stored with the metadata, even in a case where the
metadata lacks description of link information (file
name or the like), access to necessary binary data can
be made.

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Further, in an ordinary relational database, it is
necessary to store a path of search subject file and its
metadata into the database. In this case, upon movement
and/or deletion of file, the content of the data base
must be updated. On the other hand, according to the
present embodiment, as metadata and binary data are
20 stored in one file such that a search for the metadata
attached to the binary data is made, the above-described
processing upon file movement and/or deletion can be
omitted.

Further, in the above embodiment, the link
25 information is stored into the metadata storage area,
however, it may be arranged such that all the link
information are registered in a data base.

<Second Embodiment>

In the first embodiment, the method for high-speed access to metadata stored with binary data in one file has been described. As a second embodiment, a case where mutually related binary data and metadata are stored in different files will be described. Note that the system to realize data management described in the second embodiment has the same configuration as that of the first embodiment.

In some file systems, one file cannot be divisionally stored. In such case, when binary data and its metadata are stored as different files, to access the metadata at a high speed, the metadata file is written into the metadata storage area and the binary data file is written into the general area, in a similar method to that of the first embodiment.

Note that when the binary data and the metadata are stored in different files, the metadata file includes a pointer to the binary data to be referred to. Accordingly, it is not necessary to store a pointer to binary data in the metadata storage area as in the case of the first embodiment.

As described above, even in a case where binary data and metadata are stored in different files in a file system where one file cannot be divisionally stored, as only the metadata is written into a pre-provided

whether or not the 8 bytes correspond with "</PHOTO>".
If it is determined that binary data and metadata are
described in one file, the processing in the first
embodiment is performed, otherwise, the processing in
5 the second embodiment is performed. In this case,
various file formats can be handled in a flexible manner.

The present invention can be applied to a system
constituted by a plurality of devices (e.g., a host
computer, an interface, a reader and a printer) or to an
10 apparatus comprising a single device (e.g., a copy
machine or a facsimile apparatus).

Further, the object of the present invention can
be also achieved by providing a storage medium (or
recording medium) storing software program code for
15 performing the aforesaid processes to a system or an
apparatus, reading the program code with a computer
(e.g., CPU, MPU) of the system or apparatus from the
storage medium, then executing the program.

In this case, the program code read from the
20 storage medium realizes the functions according to the
embodiments, and the storage medium storing the program
code constitutes the invention.

Further, the storage medium, such as a floppy disk,
a hard disk, an optical disk, a magneto-optical disk, a
25 CD-ROM, a CD-R, a DVD, a magnetic tape, a non-volatile
type memory card, and ROM can be used for providing the
program code.

Furthermore, besides aforesaid functions according to the above embodiments are realized by executing the program code which is read by a computer, the present invention includes a case where an OS (operating system) or the like working on the computer performs a part or entire processes in accordance with designations of the program code and realizes functions according to the above embodiments.

Furthermore, the present invention also includes a case where, after the program code read from the storage medium is written in a function expansion card which is inserted into the computer or in a memory provided in a function expansion unit which is connected to the computer, CPU or the like contained in the function expansion card or unit performs a part or entire process in accordance with designations of the program code and realizes functions of the above embodiments.

As described above, according to the present invention, metadata of binary data as a search subject can be accessed at a high speed.

As many apparently widely different embodiments of the present invention can be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.